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AUTHOR Palmatier, Robert A.
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ABSTRACT

Many researchers are opposed to the use of instructional machines, but current research literature has not yet reflected the experimentation with machines and programs produced in the past 5 years. There is no doubt as to the validity of these new technologies on an experimental basis. Much good is found in the motivational and instructional aspects of machine instruction; but too much reliance on machines may reduce creativity and limit the amount of information and growth potential to a learner and at the same time result in the danger of dehumanizing learning and students. Machines currently available are (1) tachistoscopic machines providing practice and reinforcement in skill mastery and rate increase; (2) recordings and films providing reinforcement, instruction, and other guidance; and (3) other audiovisual devices providing different levels of instruction ranging from simple presentation to that which demands a response from the student. Because of financial limitations, instead of buying one of every kind of machine, schools should carefully assess their needs and purchase the most useful items, such that enough of these could be used for all classrooms. Inservice teacher training programs should emphasize the application of technology in the classroom to encourage teachers to use these machines. (AW)

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Robert A. Palmatier
Assistant Professor
College of Education
University of Georgia
Athens, Georgia

U. S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Machines in the Reading Program - What are Their Roles?

Background and Research

During a tour of a local school, Mr. Smith, the principal, quickly guides his visitors to a beautifully equipped reading lab in response to their questions about the schools reading program. They agree with him as he, beaming from ear to ear, points out the beauty and completeness of his collection. As they ask about the use of the material he continues to quote prices and relate his philosophy of "nothing-but-the-best" for his school. He still misses the point when they again ask when and how the teachers use the material. Later visits to the teacher's classrooms indicate that they do not use the equipment due to the effort required to get it and their lack of knowledge concerning its use.

This is a typical situation, replicated in schools throughout the nation. All agree that this is wasteful use of money allocated for the instruction of children. But what is the answer? Legislate against the purchase of machines because they are not used by teachers and are wasteful when used as museum pieces by proud principals? It seems unreasonable to approach the problem on such a simple minded level. There are first some more basic questions. Does machine instruction, in fact, provide for children's learning? What sorts of hardware and software <u>are</u> available for instructional uses? Once we have determined what mechanization has to offer to the teaching of reading, more advanced questions can be asked. If there is benefit, then what sort of instructional tasks can be assigned to machines? Where can machines be best used? How should they be used? Finally, when we have responded to each of these questions we must face the issue of providing for the implemenation of machines in schools and reading programs.

This paper attempts to provide answers, or at least suggest plausible routes for securing answers, to these questions. First, the research evidence on the instructional validity of machines is summarized. Second, the sorts of machine programs and aides available in the area of reading instruction are discussed in such a manner as to also indicate the type of instructional needs which can be filled with mechanized approaches. Third, comments are directed toward the place of machines in the school in order to answer the questions about where and how machines should be used. Finally, the responsibilities of teacher pre- and in-service training for the area of machines in the reading program are considered.

Looking to the standard sources of research evidence one finds much said about machines and reading. Many researchers report having tested the value of machines as opposed to traditional, or teacher and text instructional approaches.

Research View

Steryl Artley's (1968) Clearinghouse monograph on trends in secondary reading serves as a good example of the content of the literature on mechanical and programmed procedures. Of the eleven studies, Artley reports, none were total machine vs. total traditional teaching investigations. However, the results were reported in two cases to demonstrate higher performance by using machines, in one case to demonstrate higher performance by traditional method groups, and in five cases to show no significant differences between mechanical and teacher oriented programs. It is interesting to note that, regardless of the results, all researchers concluded that machines may not be worth the expense required, but none concluded likewise for traditional teaching programs even though they produced no higher levels of performance than the machines.

Possibly the above interpretations reflect the same sort of bias found by Millman (1963) when he questioned teachers and pupils on the value of mechanized instruction. Elementary teachers felt there was little value, Junior High teachers were enthusiastic about the value of machines, and high school teachers felt that they provided nothing different from the traditional approaches. Students, on the other hand, at all levels felt there was value in mechanical instruction and reported enjoying the use of such approaches.

Karlin (1958) evaluates the results of 12 studies on the use of three types of apparatus - flash meters, pacers, and films. He reports that 11 of the 12 show results favoring natural reading approaches since this approach either surpassed or equalled the results of machine instruction. Again, equaling teacher performance was assumed to be not sufficient evidence for the use of machines.

Spache (1958) alone seems to recognize that evidence which demonstrates that machines produce permanent results and do so generally as well as other methods is sufficient evidence that the value of machines should not be dismissed lightly. His conclusion was drawn in a review of 54 studies concerning the effectiveness of mechanical devices for improvement of reading rate.

Research on the effectiveness of machines in the reading program has been reported widely. However, in addition to the usual limitations of research, the studies in this area seem in general to share a unique set of compromising factors.

(1) Only machines of the earliest tachistoscopic variety have received significant attention. This means that most of the studies were limited to reading rate as a criterion variable.

(2) Almost none of the studies report pure comparisons where experimental treatments were limited to machine vs. non-machine approaches. In many cases a hodge-podge of machine and programmed activities are compared with teacher instruction. Since researchers define these two alternatives in a variety of ways, the conclusions cannot even be applied to teacher directed vs. non-teacher directed training questions.

(3) A slight interpretational bias consistently reoccurs. In cases where machine and non-machine groups do not show significant differences in achievement, which is the most reported finding, the usual conclusion is that this does not support the expenditure of funds on machines. If a reviewer were not a teacher but an economist he might conclude that the evidence does not support the expenditure of funds on teachers any more highly than the expenditure of funds on machines.

(4) The breed of machines <u>now</u> offered to the reading market is sufficiently new and different from the earlier tachistoscopic devices to exclude judgment of these offerings on the experiences with earlier machines. This requires a new thrust in research to evaluate the presently available programs. Thus, in fact, this means that the most pertinent question, that of the value of the new technology, is now largely unanswerable from a research viewpoint.

Current Indications

The research literature has not yet reflected the experimentation with machines and programs which have been produced in the past five years. Thus, one must look to popular journals, the press, public relations material, and opinions for indications on the value of the new technology. Although these sources provide less respected precedence on which to base judgments, they do provide direction for both initiating practice and planning research validation.

A demonstration project utilizing the Hoffman Reading Program with seventh graders at the Potrero School in El Monte, California indicates the increased rate of achievement possible. During the first four months of the project, February to June 1970, 84 students, in this school serving a predominantly spanish-speaking neighborhood, showed a mean grade placement gain of one year and three months on the Comprehensive Test of Basic Skills. This compared to only a two-month gain for the 78 student control group using standard teaching methods.

Experimental use of the Edison Responsive Environment, better known as the talking typewriter, in an Atlanta Public School project reported that during a two month period students gained from two to four months in achievement test performance. Another use of the ERE in Freeport, Long Island demonstrated the machines ability to provide for initial reading instruction for kindergarten age children. The machine not only succeeded in doing the job of initiating reading instruction but did so at a more rapid rate that the enriched traditional program used with the control group.

While there is little question about whether or not machines can teach there are some concerns about what and how they teach. Charles Silberman (1970) in "Crisis in the Classroom" examines totally programmed and mechanized projects like the Individually Prescribed Instruction Project in Pittsburgh. While not questioning the ability of such programs to foster learning as they do. He questions the rigidity of behaviorally designed programs which offer only one correct answer and one route to it.

In addition to this over simplification of knowledge content and rigidity of approach Silberman hints at another major problem; that of limiting individual style and creativity. We must take care that we do not allow the dehumanization of learning and students by over programming or allowing total machine instruction. At the same time there is obvious need for maintaining the human elements which only teachers can provide machines seem able to do some things humans cannot. Retaining objectivity, a vital teacher trait, is not an easy task for humans. Machines have no emotions and therefore have no problem reacting cooly and dependably at all times. Thus, students at times have indicated that one of the reasons they enjoy working with machines is because they do not yell at them or get mad. While there is much good in the motivational and instructional aspects of machine instruction it could be used in such a way as to further reduce individuality and limit the amount of information and growth potential available to a learner. Already school curriculums tend to press all students into an "average" rut. Over use of machines or failure to seek more open ended and creative program types could push us further in that direction.

A wide-spread notion, usually used to support the introduction of machines into the classroom, is that they provide release from some of the usual teaching tasks. This is usually construed to mean that the teacher will then be able to give students more individual attention in the time gained. Actual time studies in this area indicate that record keeping and machine care use up most of the time gained. Thus, while the teacher may improve the quality of records and control in his classroom he does not necessarily gain time for more individual instructional attention.

There appears to be little question concerning the validity of machine instruction, especially in the teaching of reading skills. Students do learn using machines, usually as much as with traditional teaching. In some instances students appear to learn more quickly and have higher retention using the newer technology. However, these indications are based on experimental trials rather than research controlled use. Thus, the primary question we now must ask is when and how machine learning should be used. To answer this question we must look first at what instructional approaches and material are available.

What the Market Offers

Tachistoscopic devices such as those produced by Psychotechnics, Craig, Keystone, EDL, Ken-A-Vision, Sawyers, and Rheem Califone are highly similar to the much researched speed training materials. They provide for skill improvement but cannot be charged with the introduction of skills. Primarily, the programs available concentrate on vocabulary drill, speed practice, and directional/perceptual type skills. If used to provide for increasing mastery levels and response speed these devices usually provide a motivating and student-operated approach to drill. Problems appear in attempting to use such devices with other than individuals or small groups. Too long a use period in a darkened room may produce nausea. Caution must constantly be exercised to insure that skill introduction is not being expected of such devices. Of all the currently available technology, tachistoscopic devices seem to suffer from the highest amount of breakdown time (with the possible exception of computer approaches).

Recorded programs are undisputedly the most available form of technology. Purchasers can choose cassettes, tape cartriges, reel-to-reel tapes, card mounted tape strips or records. In addition to mechanical differences, approaches vary. Some programs provide only listening pleasure or lecture instruction, others guide the student through learning and practice material, and still others also provide the capability for student response and some allow the recording of these responses.

Listening only was the initial use of recordings in reading, but today few offerings are limited to that. Some of the earliest Imperial Tape offerings and a few story-telling-type records can still be found. The majority of the recorded programs now offer some mode of visual complement. Numerous versions of the recorded book design, where the child looks at the book while listening to a record, are available. The workbook guide tape pioneered by Merrill for their skill books has been replicated by many companies. Imperial Tapes offers companion tapes for nearly all of the non-basal workbook programs. With these a teacher may assign a student to pages or sections in a workbook which provides practice in specific skill areas and to provide the needed explanation and support turn him over to a recorder. The recording provides the teacher direction phase of the task and provides explanation and readiness background for the workbook exercise.

In addition to the adaptation via recorded directions many producers offer recorded instructional and reinforcement programs especially designed to be guided by record or tape presentations. In most cases

workbooks, game cards, and other visual aids are used along with the program. These programs mostly are offered as short programs designed to work on specific skill areas. The majority of them like the Brenmer-Davis, Americana-Interstate, Rheem Califone, and other offerings, emphasize either phonic or vocabulary development.

The benefits of the program fall in the area of allowing the teacher means for greater individualization. If a recording can provide the teacher direction usually required the amount of differentiation in instructional and practice activities can be greatly increased. The problems are mostly in the logistics of using the programs. Most classrooms must undergo rather extensive reorganization and arrangement in order to accomodate a variety of hardware-oriented activities. The use of earphones solves the noise problem but does nothing about the usual lack of electrical outlets, inappropriate desks or tables, lacking room dividers, etc. Two content problems are also present in much of the material. The terms used to describe the content, often behavioral terms, are not familiar to most teachers and do not parallel the format of most basal materials. This then requires extensive teacher time to preview all of the material to determine exactly what it does. The second content problem is that in many cases a "shotgun" approach has been used in material development. By this it is meant that the general assumption, especially in that material labeled as corrective or remedial, has been that all basic skills are needed and that it is not important to design a sequence or even regular reinforcement schedule into the material. This then means that much of the material, regardless of the producer's claims, really can

only be expected to provide review and reinforcement of previously introduced skills.

Two special recorded program categories are exemplified by the card readers (language master, Bio-dynamics and EFI) and the audio-active or listen and record tape equipment. The card readers using tape strips printed on cards can be easily programmed to serve in many of the telling capacities previously limited to the teacher. Thus, they serve as talking dictionaries able to tell children unknown words when the teacher is unavailable. A second track on some card readers allows the pupil to record his response and check it against the model and thus refine his own memory and production skills. The audio-active tape recorder, as offered by Craig, allows the child to listen to a recorded segment and be recorded each time he responds as directed. This then puts the child in the position of being able to check his own responses by relistening to those segments and also records his efforts for later checking by the teacher. For both the audio-active tape recorder and the card reader only a few pre-programmed materials are available, thus leaving material development up to the teacher. While most teachers respond joyfully to this capability and opportunity in machine use, few teachers ever find time to prepare very extensive materials of their own.

Films are a rapidly growing area of mechanization in the reading field. Film loops, film strips, film strip cartriges, and overhead projector films have all been utilized for presentation of reading instruction and practice. Reading films, such as the early Harvard films,

are used for speed training. Craig, EDL, Psychotechnics, and others have utilized filmstrips in much the same manner to provide speed drills. Many filmstrips are available to reinforce specific reading skills or to provide for practice story reading. Ealing has developed a considerable stock of skill training material in the super-8 film-loop medium. Others have used the traditional film strip and various cartridge modifications of the film strip to provide for skill practice. However, most of the film-type materials are designed not as mechanized teaching programs but as teacher aides. Their major use is to illustrate the teacher's lecture-type instruction. Overhead projector material can be included in this category. The advantage of the material is that it provides superior illustrative aides for the teacher without requiring preparation time. The problems are mostly in the expense, storage, and utilization. Without classroom adaptations and special efforts at training teachers in the use of these media aides, little benefit can be expected from their purchase. The expense factor is usually considered a vital factor in that film material is expensive. However, if we look at the long range depreciation approach they provide a large amount of benefit for not unreasonable sums of money.

Audio-visual presentation devices and teaching machines are the most rapidly growing area in today's reading market. Names like, Hoffman, Borg-Warner, Westinghouse, CBS, Dorsett, Acoustifone, RCA, General Learning, Welch Scientific, and others are becoming familiar for their efforts in reading as a result of redirection of their electronic and communications knowhow. Today, a machine can, in fact, teach basic reading skills. No

longer are the hardware programs limited to reinforcement drill. The machines show and tell, and in many cases require responses of the learner in order to continue the instructional presentation. Thus, we have passed the age when machine use must be carefully guided by the teacher lest the students not benefit from the presentations.

As has always been the case, software is the major problem with such devices. To be effective and fit into the requirements of the educational system there must be appropriate and extensive programming. At this point we still have many of the "shotgun" approach type of programs but there is promise and already some evidence that developmentally sequenced and sufficiently reinforced instructional programs are not far off.

The audio-visual-presentation-type devices offer three levels of operation. Some are merely presenters, they show and tell but require nothing of the student. A second level not only offers but suggests student involvement and usually leaves spaces for pupil responses. While there is the potential for involvement there is no guarantee that involvement will take place. The highest level of teaching machine is that which not only presents but is programmed in such a way that the instructional program will not progress without periodic interaction on the part of the student. Then there is a guarantee that the teacher will become quickly aware if the program is not working.

Most of the companies mentioned in this category provide some programs in the corrective realm emphasizing vocabulary and word attack skills. Due to the advanced sophistication of this sort of hardware we are also

now beginning to see the emergence of some interesting comprehension training programs. Hoffman and others are presently showing the beginning stages of developmental programs designed to provide the core instructional medium and thus to offer an alternative to basal text approaches. As stated earlier the appearance of these devices and their accompanying programs has rushed upon us so recently that we have had little time to even learn how they work, let alone carefully evaluate what they can or cannot do. However, the initial results do seem to quite reliably indicate that there <u>is</u> a great deal of magic in the media. Current estimates seem to indicate that, at least at the intermediate and high school levels you can expect about a one-year achievement gain (as measured on standardized achievement tests) for roughly twenty hours of machine instructional time. While this may be due primarily to the nature of reading development at the levels most tested there is still little question that there is benefit of such magnitude as to require extensive efforts at providing appropriate utilization. Although many may not have seen these machines being used by children most have seen one of the second level programs which has been circulated on a national basis. "Sesame Street" piped into homes and classrooms across the nation has demonstrated that the audio-visual presentation media can do many things previously done by classroom teachers and open the doors to many areas previously closed to the learner. With this experience behind them those working with the television presentation approach should soon be offering us a new view of the world never before available in

classrooms but now recorded on TV Cassetts. Another type of media which falls in the audio-visual category is the computer. While this is not the only way in which the computer can aid instruction, to this point there has been little effort to discover other than teacher replacement roles. The fantastic expense seems to be a major deterent in the utilization of the computer. Limitations in the area of flexibility also seem for the present to keep the computer from becoming more than a highly sensitive drill provider.

In sketching the sorts of machines available(tachistoscopic, recording, film, and audio-visual devices) the sort of instructional capability was also indicated. Tachistoscopes provide reinforcement and increase in rate of operation for the student. Recordings can provide pleasure, lecture-type instruction, and guidance for workbook type activities. This medium therefore can claim the capability for both instruction and reinforcement. Films can provide all that recordings can but cannot instruct except through the print incorporated. This means that reading ability is assumed in cases where instruction is expected. When an audio track is added as in the audio-visual devices a high level of instructional capability is achieved. This instructional capability does not depend upon the students reading ability since both audio and picture illustrations are possible. But even with hardware capable of teaching, instruction does not have to take place in all of the programs. The level of instruction ranges from simple presentation to that which demands a response from the student in order to continue operation. Those interested in a categorization of automated

instructional devices according to their instructional capabilities will find the author's more extensive consideration of this aspect elsewhere (Palmatier, 1971).

Until now any suggestions as to the utilization of machines in today's schools has been left out. As indicated in the report of the visit to Principal Smith's school, the most likely present application is to the special reading room or lab. In few cases do classroon teachers have available the machines described. Even record players and tape recorders are seldom seen sights in the average school. It seems that as soon as you put a price of more than ten dollars on an item the range of consideration switches from the classroom to schoolwide purchase level. Thus, most of the devices referred to are purchased on a one per school basis or at least on a multi-classroom sharing basis. While this is recognized as an economic necessity in most cases it also appears to be one of the major reasons for teacher failure to use such materials. If they are not readily available without the necessity of making prior arrangements materials usually are not used.

Obivously if the one per school or multi-classroom sharing approach to providing machines does not result in their use by teachers a change in the pattern is advised. If schools would more carefully assess their needs and then likewise carefully assess the available products they could limit purchases to only the most useful items. If this were done rather than taking the "little of everything" approach, enough of those most useful items could be purchased for all classrooms. In addition

to failure to purchase sufficient units of hardware and software to assure their classroom use we must face the teacher knowledge barrier. Teacher training programs concentrate on the mechanics of instruction and do very little in the area of training in the contents and use of materials. Training in the use of mechanized teaching materials is rarely included even if the general topic of materials is covered. To overcome this lack in our present teachers, emphasis upon the application of technology in the classroom is called for in in-service training programs. To fill the deficit in our pre-service programs introduction to materials must be built into our reading methods courses. To help us do this we must call on the machine producers to supply our demonstration centers so that we may train future teachers to use their equipment.

We are now in the era when machine instruction has a multitude of offerings. The medium and even the specific training programs have been proven effective. We need now to explore more deeply the offerings of machine instruction in relation to specific student instructional needs. At the same time we are formulating guidelines for equipment use we also must shoulder the professional burden of preparing teachers for its use. Along with the education of teachers we must also work on re-orienting administrative purchasing policies to give innovative hardware a chance by purchasing in a manner which places the equipment in the classroom where it can be used. And finally, if professional

educators are to sensitize the teachers of the nation to appropriate use of mechanized media and teaching machines it might be appropriate to begin by utilizing some of these approaches in teacher training programs. This is a must for no matter how loudly we speak of the promise and mention the cautions, teachers are unlikely to heed the advice if they never see teachers of teachers taking their own advice.

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